

BrM Tunnel Module

- BrM 5.2.3 will have a Tunnel Inspection Module
- This is in response to FHWA's new National Tunnel Inventory
- Why?

- There is now a Tunnel coding guide, the Specification for the National Tunnel Inventory (SNTI)
- All states with tunnels need to follow it.
- States need a place to store their tunnel data
- States need a way to submit their data to the FHWA.
- BrM got elected

History

- According to my memory
- Any resemblance to reality is purely coincidental

Back in Ought Six...

- FHWA was considering tunnel inspections for some time
- 2006 (or thereabouts) release of OneDOT
- Tunnel Inspection Software
- User defined elements
- Tunnel divided into user defined sections called panels
- Use FHWA style ratings, 1-9

- 2006, Big Dig (Boston) failure of roof panel caused fatality.
- FHWA's Tunnel role changed from advisory to regulatory
- By 2008 there was an FHWA advance notice of proposed rule making for tunnel Inspection

- Not sure when work on inspection manual begun
- ODOT involved in reviews
- I didn't keep my reviews. Hoping it would go away?

- First version of the manual stayed with NBI rating style, 1-9.
- Initial language lacking—not much about tunnels in tunnel rating language
- Reviews reflected this
- Several iterations came out and were reviewed

Foreshadowing Alert

During this process, at an inspectors' conference in Oregon, one of our managers asked an FHWA Representative (publically) "Will we be able to store tunnel data in Pontis?"

The FHWA representative answered absolutely, positively, unequivocally NO!

- Finally, the tunnel coding manual was looking pretty good, almost ready for release.
- Someone had an epiphany.
- The tunnel manual should be set up just like the new AASHTO element manual.
- Junk everything, start all over.

New, Improved Tunnel Manual

- The new manual format was not terribly different from the current SNTI (Specifications for the National Tunnel Inventory)
- Unlike bridges, most elements not structural
- Originally, Elements Gone Wild. There was an element for the gas cap on the backup emergency generator.

- Structural element language taken straight from AASHTO Bridge Elements
- Again no tunnel specific language.
- Reviewers displeased, changes made
- 2012, manual 75% complete
- 2015 Manual released

Enter BrM

- Tacit assumption just put this stuff in BrM, despite earlier contrary opinion.
- Ran with this assumption for a long time.
- Finally the idea occurred that maybe, just maybe they should get in touch with the taskforce to determine feasibility

Hilarity Ensued



- FHWA SNTI items for Tunnels not a good match with NBI items for Bridges
- Can't use same screens
- Can't use same tables
- Can't use BrM as it stands, need to add new module

Major Concerns for Taskforce:

Br in BrM stands for Bridge.

Do enough Users want tunnels to justify spending BrM money to put a tunnel module in?

And



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Can you say “elicitation”?

10 states agreed to contribute

- Oregon
- New York
- Wyoming
- Alabama
- Kentucky
- Tennessee
- New Mexico
- Virginia
- Colorado
- Texas

Some of these states volunteered to participate in a Tunnel TRT to help Bentley.

Bentley original proposal

- Collect what's in the SNTI (no defects)
- Add a couple of other fields, such as inspector
- Only Routine Inspection recorded
- Generate FHWA XML submittal

TRT response: Nope we need more

- Ability to use Structure Units
- Add Defects as in Bridge module
- Inspection Screen to track dates, frequencies
- Work Screen for Maintenance needs
- Multimedia Screen

Bentley developed costs for these and presented them to the taskforce



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With funds in elicitation + other funds scraped together
Task Force can fund:

- Ability to use Structure Units
- Add Defects as in Bridge module
- Inspection Screen to track dates, frequencies

The others

- Work Screen for Maintenance needs
- Multimedia Screen

Are just too expensive this time. Maybe later.

TRT Reaction



Some states deem Work and Multimedia essential. So essential that

- Alabama
- California
- Idaho
- Oregon

Banded together to contribute enough service units to get these features into the product

So There!



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Tunnel Module Delivered in 2 Phases

Phase 1

- All NTIS fields, Structure Units, Defects, Inspection Screen, will be able to create submittal for FHWA

Phase 2


- Work Screen and Multimedia

- Phase 1 delivered with or within a month of BrM 5.2.3 release
- Phase 2 delivered 1 or 2 months after Phase 1, or longer....
- Depends on when TF and Bentley get requirements for phase 2 from the concerned states

Phase 1 Tunnel Module



- Let's take a peak.
- Screenshots courtesy of the Functional Design Specification
- i.e. I haven't seen the real deal either.


Tunnel List


Pontis User

Tunnels > Tunnel List

?

 
Filter:
Layout:



- BRIDGES
- REPORTS
- ADMIN
- INSPECTION
- GATEWAY
- ANALYSIS
- PROJECTS
- TUNNELS
- TUNNEL LIST**
- TUNNEL INVENTORY
- TUNNEL INSPECTION

Tunnel ID	Name	Inspector	Insp Date	District	County	Owner
<input type="checkbox"/> 0011111T	I-15 Tunnel Under Special Mountain	Dan Adams	6/9/2015	Region 4	Somewhere Co.	State Highway Agency
<input type="checkbox"/> 0011112T	US-89 Uter Tarabithia River	Clint McCleery	4/12/2016	Region 3	Tarabithia Co.	State Highway Agency
<input type="checkbox"/> 0011212T	I-15 Through Hidden Canyon	Zac Boyle	5/3/2015	Region 4	Somewhere Co.	State Highway Agency
<input type="checkbox"/> 0011213T	Beautiful Highway Tunnel	Josh Johnson	2/25/2016	Region 2	Fictional Co.	State Highway Agency
<input type="checkbox"/> 1234543T	Squirrel Hill Tunnel	Amy Loomis	11/1/2015	Region 4	Nowhere Co.	State Highway Agency
<input type="checkbox"/> 0011214T	The Wawona Sequoia Tree	Clayton Garcia	5/14/2016	Region 1	Mythical Co.	State Highway Agency
<input checked="" type="checkbox"/> 0011215T	I-15 Tunnel to Nowhere	Dan Adams	5/23/2016	Region 2	Nowhere Co.	State Highway Agency
<input type="checkbox"/> 1	New Tunnel	Kelly Lexa	9/10/2016	Region 4	Somewhere Co.	State Highway Agency

⏪ < 1 2 3 4 5 > ⏩

Page size:

49 items in 5 pages

- Not really different from Bridge List
- Will be able to select, create, duplicate and delete tunnels
- Can build new layouts, filters with the same page you use for Bridge

Not Included in Tunnel List

Manage Bridge Analysis Groups
Mapping

Total Bridges: 11689 Matching Filter: 11689 Selected: 1

Context: Bridge Level Image 1 of 7 Zoom In




Inspection - 9/22/2015 (HTZK)

Condition	Load Rating	Inventory	Roadway On	Schedule
Health Index:	70.7			
Sufficiency Rating:	17.9			
SD / FO Status:	Functionally Obsolete			
Deck (58):	5 Fair			
Superstructure (59):	5 Fair			
Substructure (60):	5 Fair			
Channel (61):	7 Minor Damage			
Culvert (62):	N N/A (NBI)			

Also Not Included

- No Sufficiency Rating (Well Duh)
- No mapping. May be added in the future
- No validation rules this time around. Not enough time.

Tunnel Inventory



Pontis User

Tunnel

Tunnel Name (I2): Squirrel Hill Tunnel

Metric
English

Tunnels > Tunnel Inventory
?



- BRIDGES
- REPORTS
- ADMIN
- INSPECTION
- GATEWAY
- ANALYSIS
- PROJECTS
- TUNNELS
- TUNNEL LIST
- TUNNEL INVENTORY**
- TUNNEL INSPECTION

Location Data

Tunnel Number (I.1):

Tunnel Name (I.2):

Place Code (I.5):

County Code (I.4):

State Code (I.3):

Highway Agency District (I.6):

Tunnel Portal's Latitude (I.13):

Tunnel Portal's Longitude (I.14):

District (C.1):

Operator (C.2):

Urban Code (C.8):

Geometry & Restriction Data

Number of Bores (S.1):

Tunnel Shape (S.2):

Portal Shape (S.3):

Ground Conditions (S.4):

Complex (S.5):

Tunnel Length (G.1): feet

Minimum Vert Clearance (G.2): feet

Roadway Width, C to C (G.3): feet

Left Sidewalk Width (G.4): feet

Right Sidewalk Width (G.5): feet

Height Restriction (L.10):

Under Navigable Waterway (N.1):

Navigable Waterway Clearance (N.2): feet

Border Tunnel

State or Country Code (I.15):

Financial Responsibility (I.16):

Border Number (I.17):

Inspection Responsibility (I.18):

Tunnel Age

Year Built (A.1):

Year Rehabilitated (A.2):

Route Data

Route Number (I.7):

Facility Carried (I.10):

IRS Route ID (I.11):

IRS Milepost (I.12):

Route Direction (I.8):

Direction of Traffic (C.3):

Total Number of Lanes (A.3):

AADT (A.4):

ADTT (A.5):

Year of AADT (A.6):

Detour Length (A.7): miles

Load Rating

Load Rating Method (L.1):

Inventory Load Rating (L.2):

Operating Load Rating (L.3):

Posting Load - Gross (L.5): Tons

Posting Load - Axle (L.6): Tons per Axle

Posting Load - Type 3 (L.7): Tons

Posting Load - Type 3S2 (L.8): Tons

Posting Load - Type 3-3 (L.9): Tons

Route Classification

Route Type (I.9):

Service in Tunnel (A.8):

Toll (C.4):

NHS Designation (C.5):

STRAHNET Designation (C.6):

Functional Classification (C.7):

Structure Units

Key	Structure Unit Name	Default	Active
1	NS Bore	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	SE Bore	<input type="checkbox"/>	<input checked="" type="checkbox"/>

[Add Structure Unit](#)

Tunnel Notes

- Items are arranged “logically” instead of by SNTI section.
- SNTI Section and Number displayed in parentheses like NBI item numbers in BrM



Pontis User

Tunnel:

Tunnel Name (I.2): Squirrel Hill Tunnel

Metric

English



Tunnels > Tunnel Inventory



BRIDGES

REPORTS

ADMIN

INSPECTION

GATEWAY

ANALYSIS

PROJECTS

TUNNELS

TUNNEL LIST

TUNNEL INVENTORY

TUNNEL INSPECTION

Location Data

Tunnel Number (I.1)	<input type="text" value="123455432112345"/>
Tunnel Name (I.4)	<input type="text" value="Squirrel Hill Tunnel"/>
Place Code (I.5)	<input type="text" value="12345 - Middle City"/>
County Code (I.4)	<input type="text" value="1 - Nowhere Co."/>
State Code (I.3)	<input type="text" value="1 - Alabama"/>
Highway Agency District (I.6)	<input type="text" value="04 - Region 4"/>
Tunnel Portal's Latitude (I.13)	<input type="text" value="25.45515278"/>
Tunnel Portal's Longitude (I.14)	<input type="text" value="110.45515278"/>
Owner (C.1)	<input type="text" value="01 - State Highway Agency"/>
Operator (C.2)	<input type="text" value="01 - State Highway Agency"/>
Urban Code (C.8)	<input type="text" value="04033 - Auburn, AL"/>

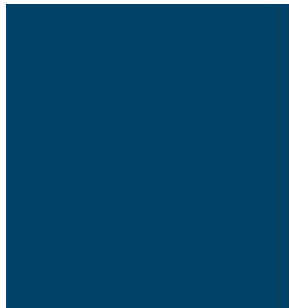
Border Tunnel

State or Country Code (I.15)	<input type="text" value="CA - Canada"/>
Financial Responsibility (I.16)	<input type="text" value="55 %"/>
Border Number (I.17)	<input type="text" value="Go Canada! 1"/>
Inspection Responsibility (I.18)	<input type="text" value="1 - Shared"/>

Geometry & Restriction Data

Number of Bores (S.1)	<input type="text" value="1"/>
Tunnel Shape (S.2)	<input type="text" value="1 - Oval"/>
Portal Shape (S.3)	<input type="text" value="2 - Horseshoe"/>
Ground Conditions (S.4)	<input type="text" value="3 - Mixed Face"/>
Complex (S.5)	<input type="text" value="0 - Not Complex"/>
Tunnel Length (G.1)	<input type="text" value="5,103"/> feet
Minimum Vert Clearance (G.2)	<input type="text" value="16.5"/> feet
Roadway Width, C to C (G.3)	<input type="text" value="24.0"/> feet
Left Sidewalk Width (G.4)	<input type="text" value="3.5"/> feet
Right Sidewalk Width (G.5)	<input type="text" value="1.5"/> feet
Height Restriction (L.10)	<input type="text" value="0 - No"/>
Under Navigable Waterway (N.1)	<input type="text" value="1 - Navigable Waterway"/>
Navigable Waterway Clearance (N.2)	<input type="text" value="60.63"/> feet

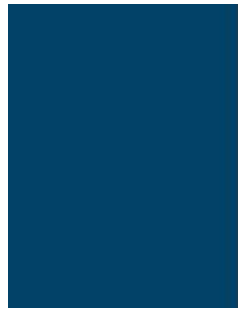
Almost everything on the inventory page is from the SNTI. Two exceptions. Here's one:



Structure Units				
Key	Structure Unit Name	Default	Active	
1	NB Bore	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	X
2	SB Bore	<input type="checkbox"/>	<input checked="" type="checkbox"/>	X

Add Structure Unit

The other, Tunnel Notes. Basically the same thing as Structure notes for Bridges. Just a structure level note field to use as you wish.

A screenshot of a software interface showing a form field. At the top left of the form is a dark blue tab labeled "Tunnel Notes". Below the tab is a yellow sticky note icon. To the right of the icon is a large, empty rectangular text input area. A horizontal line with a right-pointing arrow is positioned above the form, indicating a scrollable area.

Inspections

- FHWA model. One and only 1 inspection recorded, Routine.
- No new inspection created until next routine.
- i.e. Any information from special inspections after the last routine gets entered into the last routine.
- TRT didn't like it

New Inspection

- This is very similar to the BrM 5.2.2/5.2.3
- Multiple inspection types available.
- Create a new inspection, all info from the previous inspection comes over
- That way, latest inspection has all data and latest data needed for the submittal.
- Agency can keep track of data for separate inspections, need not all be buried in routine.

New Inspection

- Separate Mechanical, Electrical, Fire Suppression inspections not part of SNTI
- These would all be part of Routine Inspection
- TRT recognized may not be able to get all personnel on site at once, Routine may need to actually be multiple inspections.

Create New Inspection

Similar To BrM


Check a box in the Types of Inspection Performed group, the date in Inspection date will be placed with the appropriate inspection when you click the create button

The screenshot shows the 'New Tunnel Inspection' form in the Pontis system. The interface includes a navigation menu on the left with the following items: BRIDGES, REPORTS, ADMIN, INSPECTION (selected), and GATEWAY. The main form area is titled 'Tunnels > New Tunnel Inspection' and contains the following sections:

- Inspection Schedule:** Includes fields for 'Routine Inspection', 'Team Leader' (set to '62 - Dan Adams'), and 'Inspection Date (D.2)' (set to '11/05/2009').
- Types of Inspection Performed:** A list of checkboxes for different inspection types: Routine (checked), In Depth (checked), Damage, Special (with a dropdown menu set to 'Collision'), Mechanical, Electrical, and Fire Suppression.

Tunnel Inspection

Portia User



- BROGERS
- REPORTS
- ADMIN
- INSPECTION
- GATEWAY
- ANALYSIS
- PROJECTS
- TUNNELS
 - TUNNEL LIST
 - TUNNEL INVENTORY
 - TUNNEL INSPECTION

Tunnel:
Inspection:

Tunnels > Tunnel Inspection

First Routine Inspection

Routine Inspection Target Date

Summary

Inspection Date:

Inspector:

Types of Inspection Performed

- Visual
- In-Depth
- Damage
- Special
- Mechanical
- Electrical
- Fire Suppression

Inspection Schedule

Scheduled	Inspector	Current Date	Frequency
Routine Inspection	<input type="text" value="E2 - Dan Adams"/>	<input type="text" value="11/05/2009"/>	<input type="text" value="24"/> Months
In-Depth Inspection		<input type="text" value="11/05/2009"/>	<input type="text" value="24"/> Months
Damage		<input type="text" value="4/21/2009"/>	
Special Inspection	Type: <input type="text" value="Collapse"/>	<input type="text" value="4/21/2009"/>	<input type="text" value=""/> Months
Mechanical	<input type="text" value="Jan Einholt"/>	<input type="text" value="11/05/2009"/>	<input type="text" value="48"/> Months
Electrical			<input type="text" value=""/> Months
Fire Suppression	<input type="text" value="Thad Peckerton"/>	<input type="text" value="11/29/2009"/>	<input type="text" value="24"/> Months

Damage Inspections performed since last reported inspection:

General Inspection Data

Tunnel Lead Protection Status:

Maximum Material Penetration:

Other Penetrations:

Tunnel or Portal Lead Protection from Inspection:

Inspection Notes

These notes would be at the inspection level. Maybe including something like the members of the team, the fact that it was a three day inspection and so on.

Element Conditions

2011 Current Concrete

Elem	Qty	Unit	Description	Quantity	Units	Qty. 1	Qty. 2	Qty. 3	Qty. 4
10001	1	SP	Concrete Tunnel Liner	23,727.45	(SQFT)	23,500	25.00	20	0.0000
10002	1	Coating	Concrete	23,727.45	(SQFT)	23,300		25	
10003	1	Steel Corrosion Protection	Concrete	23,727.45	(SQFT)	23,700			
10004	1	Concrete Passageway		45	(LF)	44			
10005	1	Concrete Portal		75	(SQFT)	75			
10006	1	Fire Detection System		2	(SIGNAL)	2			

Element notes for concrete Cross Passageway should go down here. The inspectors can type away happily and make what paragraphs about the condition, but the text will wrap and they will be so happy

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 Version 3.2.2 (Rev. December 2008) (Released: Wednesday, April 15, 2011)
aashtoware.org / AASHTO.org

First Routine Inspection

Sorry for the quality. Stole this from the FDS

This is Routine Inspection Target Date at the top of the form

The screenshot shows a web interface for 'Tunnels > Tunnel Inspection'. A blue header bar contains the breadcrumb text and a help icon. Below it, a section titled 'First Routine Inspection' contains a label 'Routine Inspection Target Date (D.1):' and a text input field with the value '11/05/1999'.

- Routine Inspection Target Date is an odd duck
- Date you **anticipate** you will inspect the tunnel using SNTI for the first time.
- May not agree with actual first inspection date
- Once entered, this date should NEVER change (unless you get special permission from FHWA)

Summary Section

Pretty much a recap of the information on New Inspection Screen

The screenshot shows a web application interface. On the left is a vertical navigation menu with the following items: BRIDGES, REPORTS, ADMIN, INSPECTION, GATEWAY, ANALYSIS, and PROJECTS. The main content area is titled 'Summary' and contains the following information:

Inspection Date:	11/05/2009
Inspector:	62 - Dan Adams

Types of Inspection Performed

Routine	<input checked="" type="checkbox"/>
In Depth	<input checked="" type="checkbox"/>
Damage	<input type="checkbox"/>
Special	<input type="checkbox"/>
Mechanical	<input type="checkbox"/>
Electrical	<input type="checkbox"/>
Fire Suppression	<input type="checkbox"/>

Inspection Schedule

PROJECTS

TUNNELS

TUNNEL LIST

TUNNEL INVENTORY

TUNNEL INSPECTION

Inspection Schedule

Scheduled	Inspector	Current Date	Frequency
Routine Inspection	62 - Dan Adams	(0.2) 11/05/2009	(0.3) 24 Months
In-Depth Inspection (0.4)		11/05/2009	24 Months
Damage		4/21/2008	
Special Inspection (0.5)	Type: Collision	4/21/2008	
Mechanical	Jon Bishoff	11/05/2009	48 Months
Electrical			
Fire Suppression	Thad Pinkerton	11/20/2009	24 Months
Damage Inspection performed since last reported inspection (0.5):		0 - Not Performed	

- Most of the fields in this group not NTI
- They are there to allow agencies to better track inspections, they will not be submitted to FHWA.
- Use 'em if you want

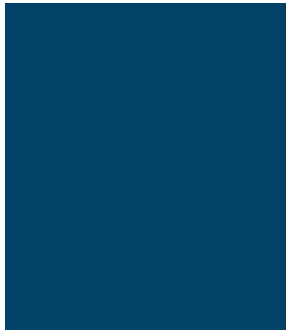
General Inspection Data

General Inspection Data

Tunnel Load Posting Status (L.4):	A - Open, Not Posted
Hazardous Material Restriction (L.11):	0 - No
Other Restrictions (L.12):	0 - No
Tunnel or Portal Island Protection from Navigation (N.3):	0 - Not Required

- These 4 fields all NTI
- My personal opinion is these should be inventory, not Inspection fields
- You may disagree

Inspection Notes



Inspection Notes

 These notes would be at the inspection level. Maybe including something like the members of the team, the fact that it was a three day inspection and so on.

- General notes for the inspection
- Like Bridge inspection notes
- Use for whatever you want
- Not a NTI field

Element Condition

- All Structure Units -

Quantity
 Percent

SNTI Tunnel Elements

Add Defect

Add Protective System

Add New Element

Edit Element

Elem	Str. Unit	Description	Quantity	Units	Qty. 1	Qty. 2	Qty. 3	Qty. 4	
10001	1	CIP Concrete Tunnel Liner	25,757.05	(SQFT)	25,500	25.05	50	0.000	✕
10951	1	Conc Corrosion Protective	25,757.05	(SQFT)	25,757				✕
1030	1	Cracking	25,757.05	(SQFT)	25,550		25		✕
10031	1	Conc Cross-Passageway	45	(LF)	44	1			✕
10051	1	Concrete Portal	75	(SQFT)	75				✕
10650	1	Fire Detection System	2	(Each)	2				✕

Element notes for concrete Cross-Passageway would go down here. The inspections can type away happily and leave small paragraphs about the condition, but the text will wrap and they will be so happy.

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Cancel

Save

Create New Inspection

Delete Inspection

- Nothing to see here folks, move along.
- Pretty much a clone of the element part of the Condition Screen in Bridge

Admin Functions

- The Datadict for tunnels will be the same as for bridges. Same screen
- The screen for Element/Defect/Protective System linking will function identically to that used for bridges
- Will be able to import the XML submittal you generated in December for the FHWA to get your tunnels in the database
- Will do XML import, export. Will not do PDI import, export so no check in check out.

Element Definitions

USER, PONTIS Admin > Tunnels > Asset Element Definitions

BrM AASHTOware Bridge Management

BRIDGES REPORTS ADMIN SECURITY GENERAL CONFIG MAPPING MODELING CONFIG AGENCY GATEWAY **TUNNELS** INSPECTION GATEWAY ANALYSIS PROJECTS PROGRAMS

Asset Element Definitions

Filter: Not Filtered

ID	Short Name
1	

Create New Copy >>

Element Details

Element Rollup Key: Undefined

Element Key: 1

Short Name:

Long Name:

Notes:

Units: Please Select

NTIS
 Defect
 Protective System/Wearing Surface

Manual

Choose File No file chosen Upload

Classifications

Category: Please Select Material: Please Select Type: Please Select

- Please Select
- 0 Structural
- 1 Civil
- 2 Mechanical
- 3 Electrical
- 4 Fire/Life Safety
- 5 Signs
- 6 Protective Systems
- 7 Other

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Save Revert

- Major difference between Tunnel and Bridge element definition screens is no modelling parameters for tunnels.
- All elements except defects are NTIS unless agency adds their own. So you can have an element that is both NTIS and is a protective system
- It is possible to roll agency elements up into NTIS elements, just like with bridges.
- Element Category looks like SNTI sections

Finally, With a Defect, you can define condition states, just like BrM

USER, PONTIS

Admin > Tunnels > Asset Element Definitions

Element Definitions

Elements

Filter: Not Filtered

ID	Short Name
1	

Create New Copy >>

Element Details

Element Rollup Key: Undefined

Element Key: 1

Short Name:

Long Name:

Notes:

Units: Please Select

NTIS

Defect

Protective System/Wearing Surface

Manual

Choose File No file chosen Upload

Classifications

Category: Please Select Material: Please Select Type: Please Select

Condition State Definitions

ID	NAME	DESCRIPTION
CS1	Good	
CS2	Fair	
CS3	Poor	
CS4	Severe	

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Save Revert

Questions?

